Consortium for Electric Reliability Technology Solutions

CERTS Research Supporting Reliability Performance Standards

Interconnections Abnormal Frequency Events Selection Methodology for Supporting Definition of NERC Control Standards

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NERC NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

CERTS CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Presentation Outline

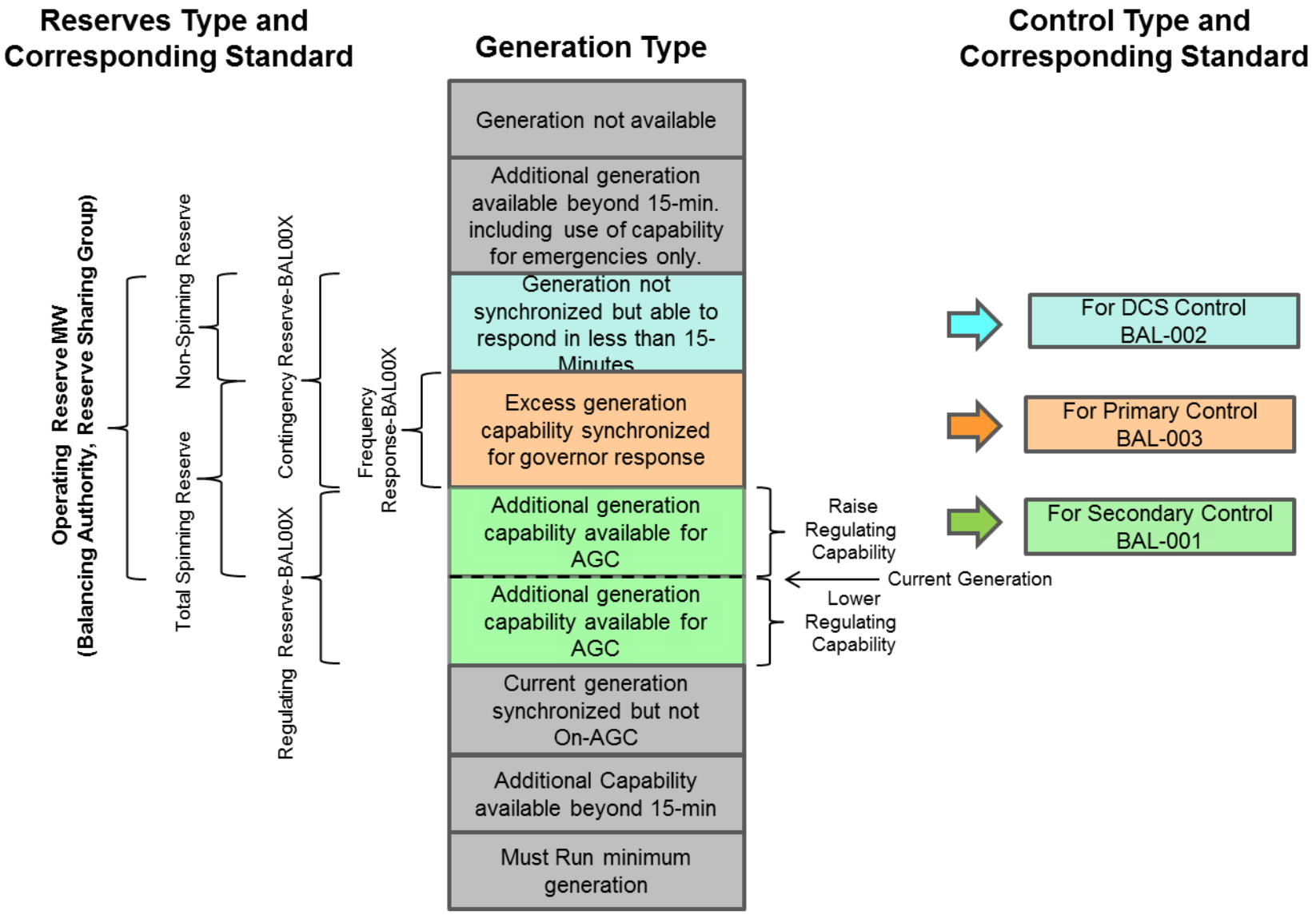
- *NERC Interconnection Frequency Response standard definition process*

- *NERC standards for control (BAL) – Overview*

- *Selection of Interconnections frequency events – Overview*
  - *Preliminary automatic event selection process*
  - *Definition of Events Frequency Values A, B, and C*
  - *Final Resources Subcommittee events selection*

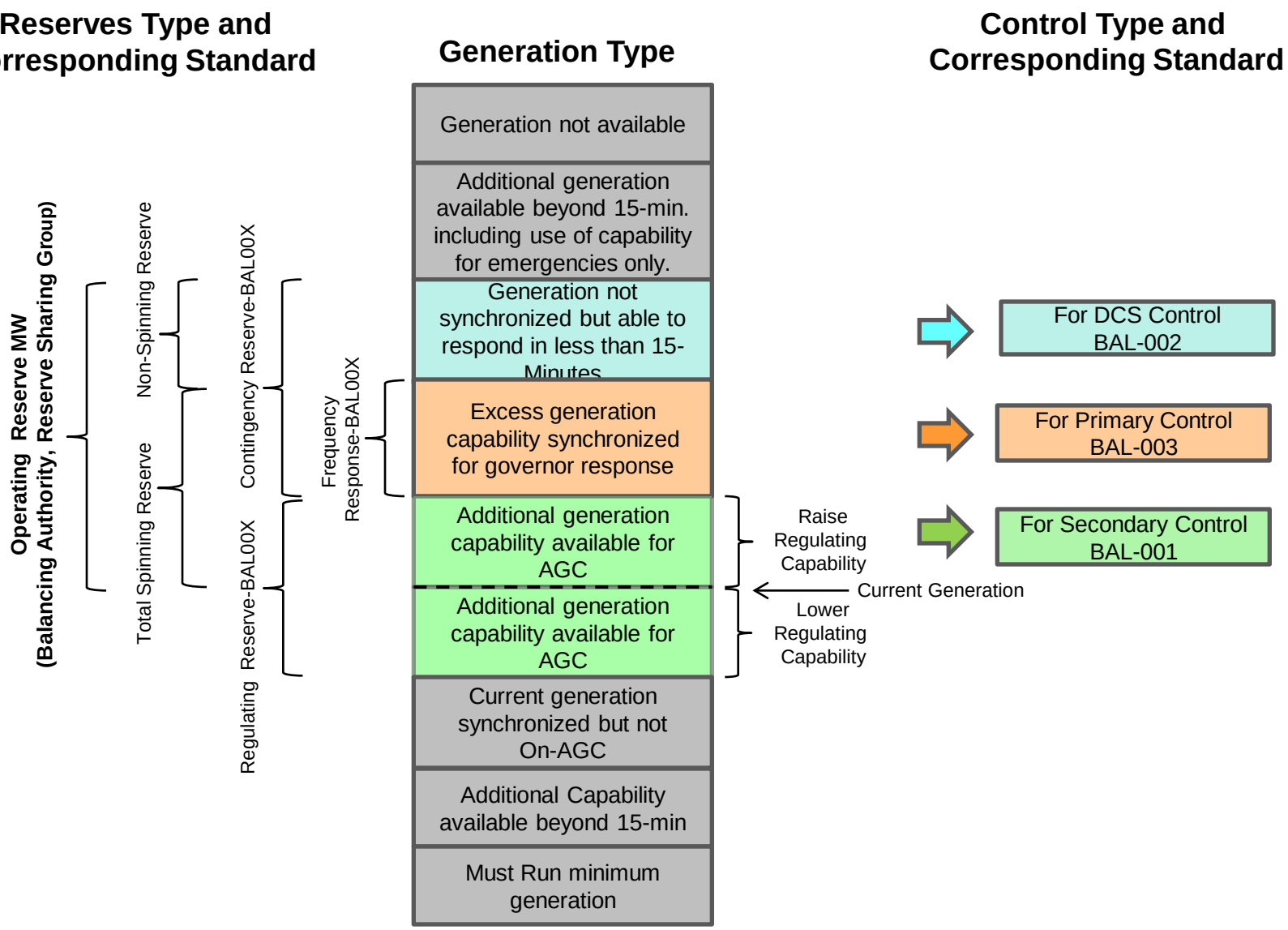
NERC Standards for Control BAL- Overview

NERC Standards for Control



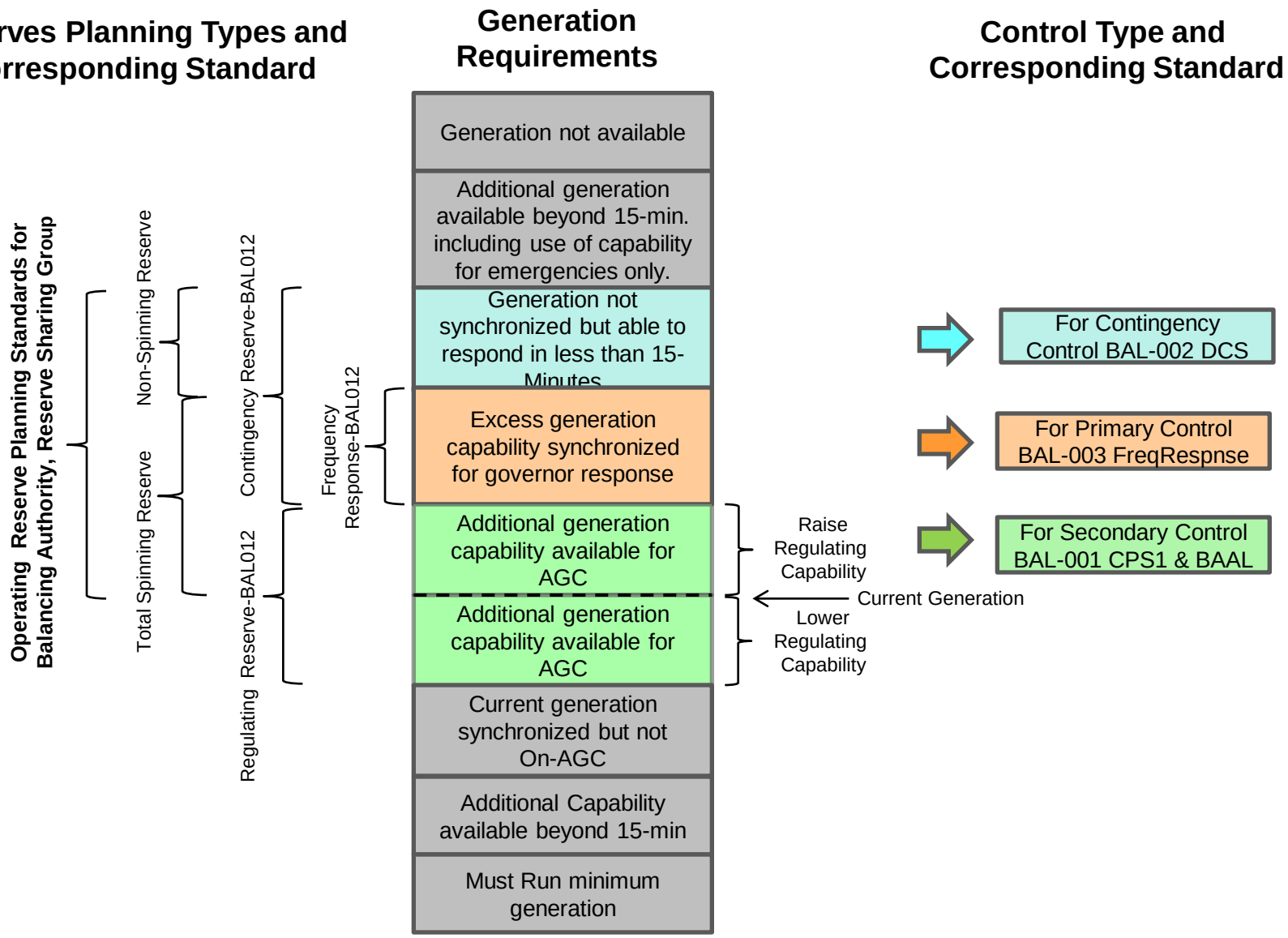
NOTE: CERTS interpretation of propose NERC control and reserves standards as of 8/11/11

NERC Reserves-Control Types and Standards



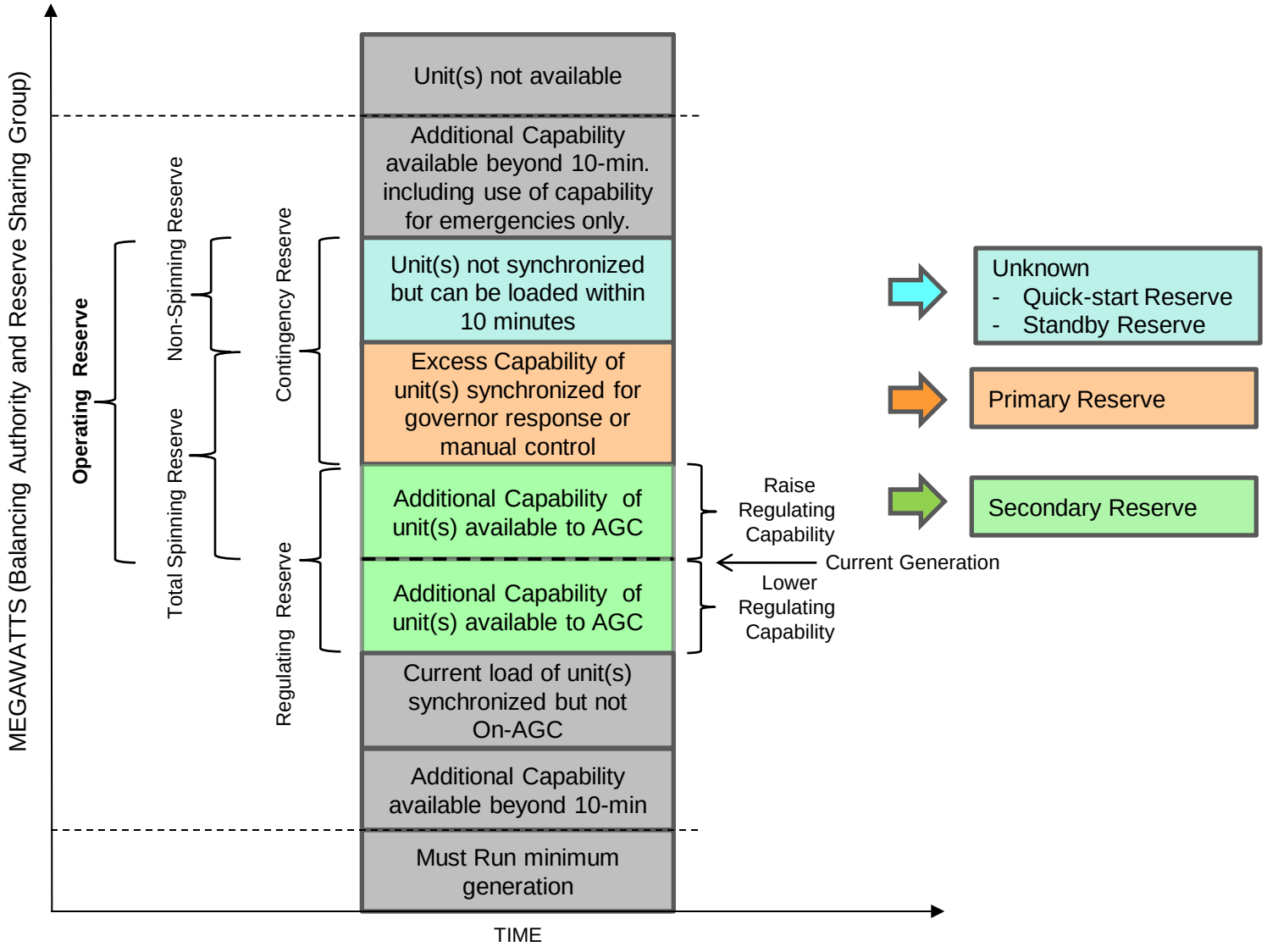
NOTE: CERTS interpretation of propose NERC control and reserves standards as of 8/11/11

NERC Standards for Control and Reserves

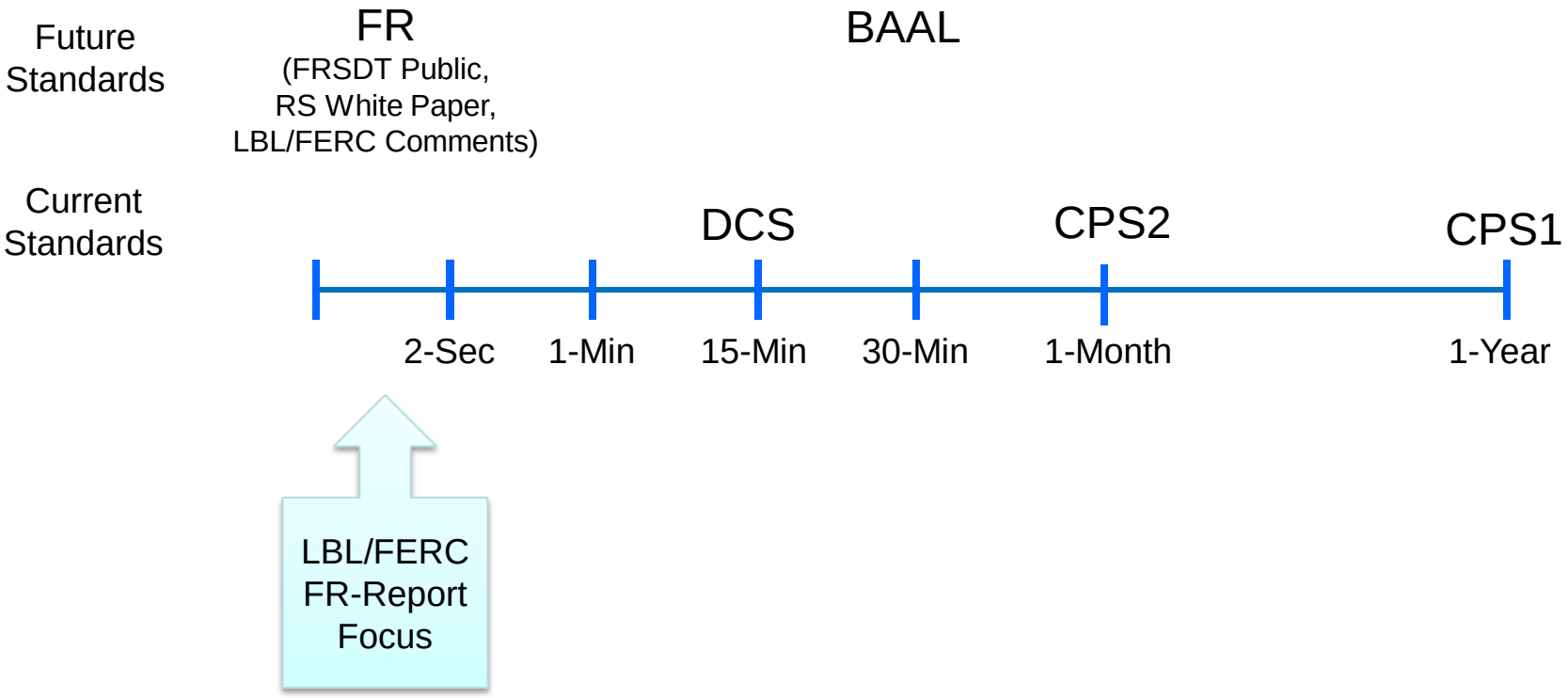


NOTE: CERTS interpretation of propose NERC control and reserves standards as of 8/11/11

NERC Standards for Control



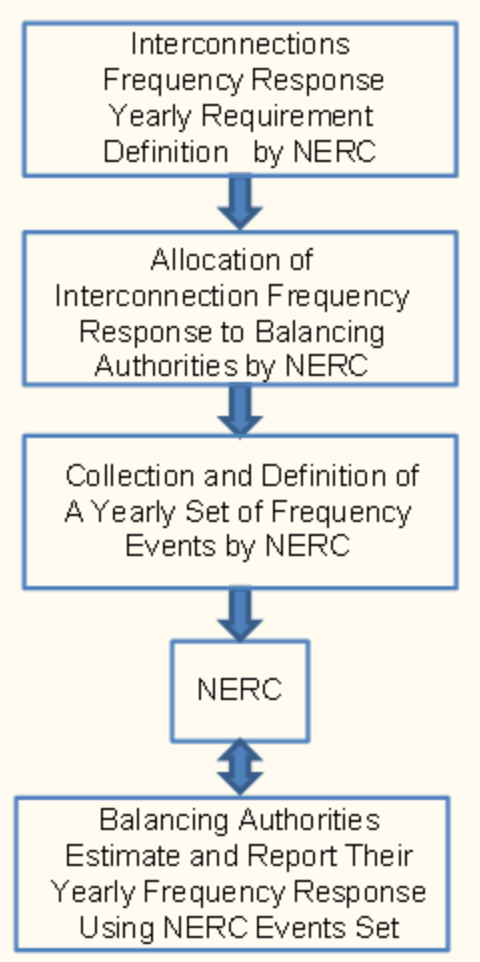
Background - Current and Future Control Performance Standards



NERC Interconnections Frequency Response Standard Definition Process

NERC-FRSDT Proposed Process for a Frequency Response Standard

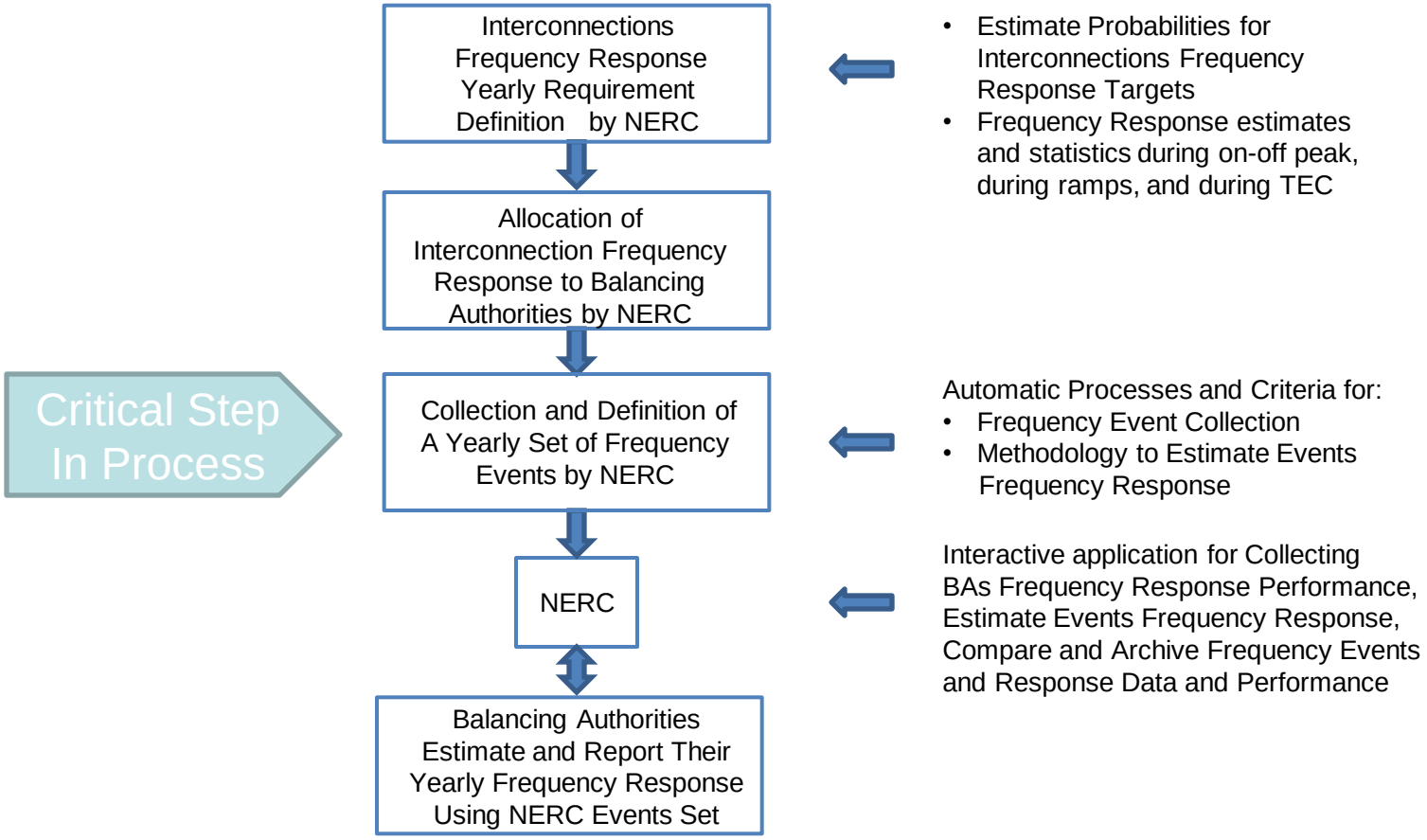
Critical Step In Process



NERC-FRSDT Proposed Process for a Frequency Response Standard

PROPOSED FREQUENCY RESPONSE STANDARD PROCESS

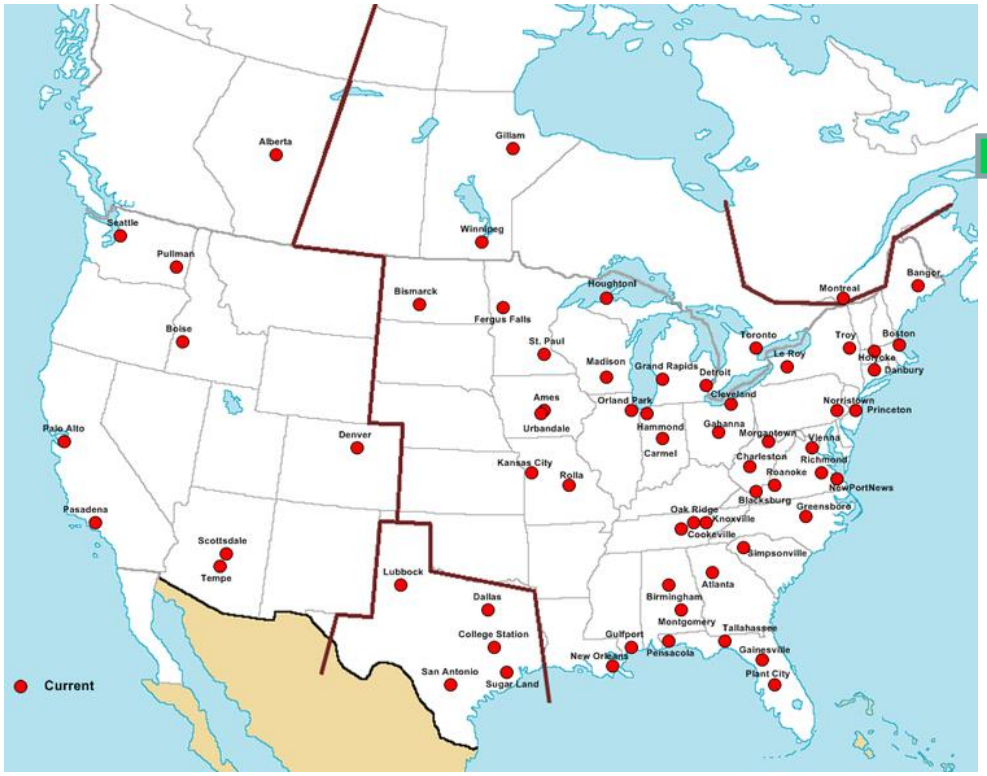
CERTS RESEARCH SUPPORTING FREQUENCY RESPONSE STANDARD DEFINITION AND VALIDATION



Data Collection and Process for Preparing a Preliminary Monthly List of Interconnections Frequency Events

Data Collection and Archive for Preparing Monthly List of Abnormal Frequency Events

Frequency Monitoring Network (FNET)



University of Tennessee

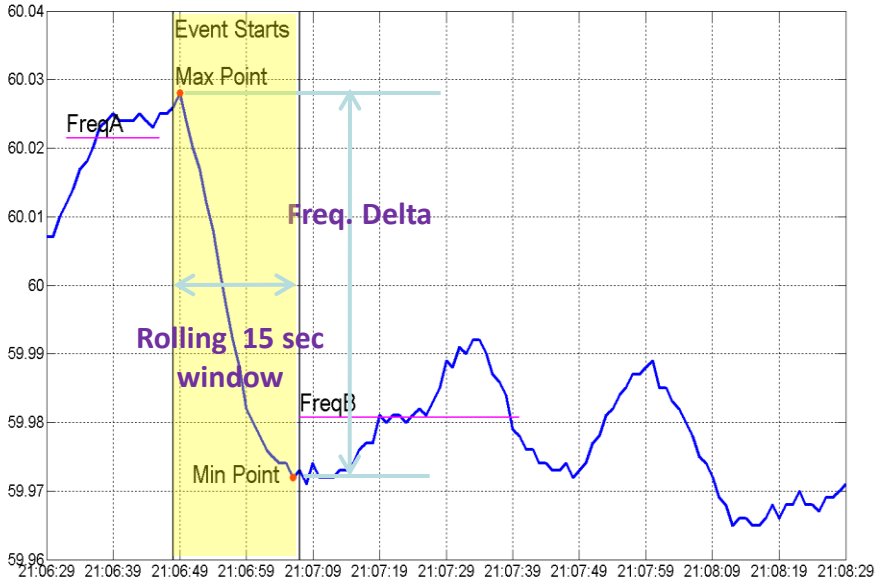
NERC **F**requency **M**onitoring **A**pplication

Historical Archive

Monthly Events Report

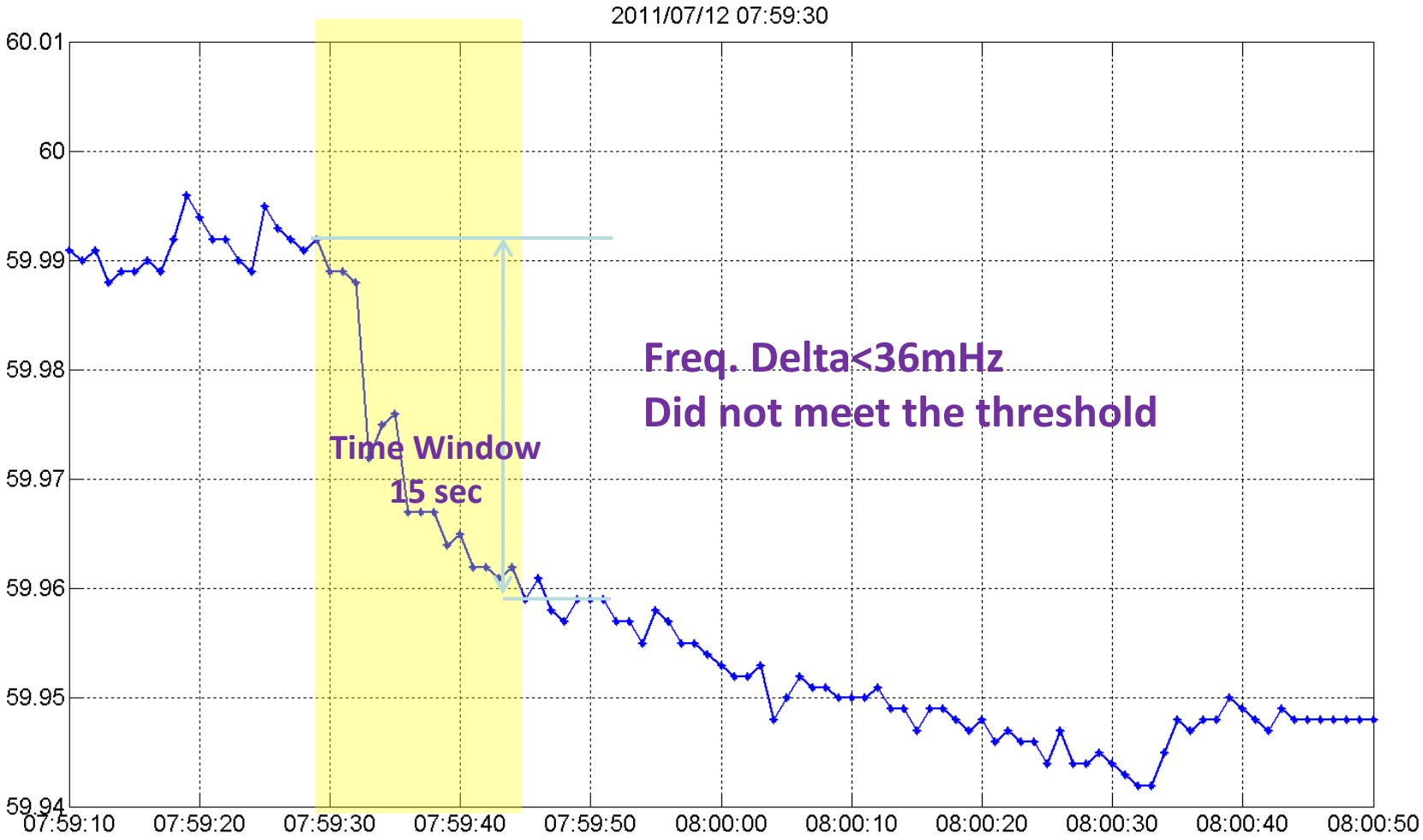
Criteria for Automatic Frequency Events Identification

A frequency event is detected and captured if during a 15-second rolling window the frequency jumps beyond the frequencies shown in the table below for each interconnection. The table thresholds are being tune



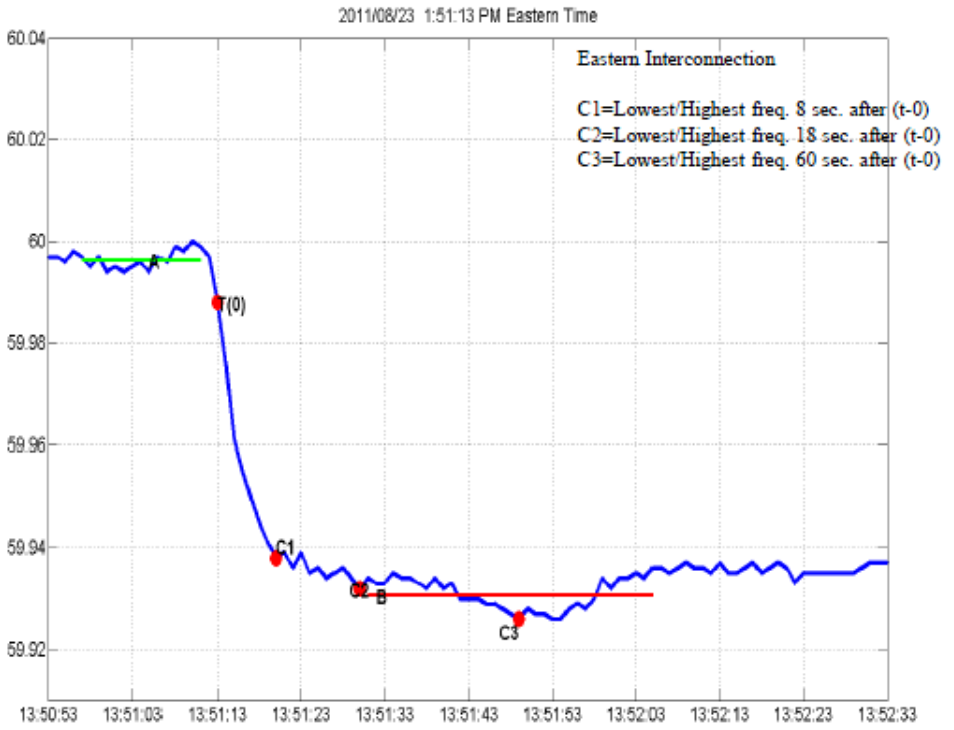
	DELTA Methodology	
Interconnections	Freq. Delta Threshold for Significant Event(mHz)	Time Window (second)
Eastern	36	15
Western	70	15
ERCOT	90	15
Quebec	140	15

Frequency Trace for Eastern 7/12/2011 Event



FRSDT Criteria to Define Events Frequency Values A, B, and C

	A	B	C
	Balancing Authority Name:	My BA	
	Balancing Authority Frequency Response Obligation (FRO from FRS Form 1)	-80	
	Note: See "Instruction" tab for more detailed instructions.		
Step 1.	Copy and Paste Event Data into the appropriate cells of the "Data" worksheet. Maintain date and time format of mm/dd/yy hh:mm:ss.		
Step 2.	Determine Time of T(0) and edit formula in cell "C8" to reference the correct row of the "Data" worksheet. T(0) is the first change in frequency of about 0.010 Hz (10 mHz) which should be the first scan of frequency data of the event.		2:27:24



BAL-003-1 - Frequency Response and Frequency Bias Setting
B. Balancing Authority Frequency Response Survey Instructions

Line-by-line instructions for the survey form follow:

FRS Form 1 Date/Time		*Point "A" Information*		*Point "B" Information*		*SEFRD*	*Internal*
Column A (XXXX Prevailing)	Column B DelFreq	Column C Load	Column D NAI	Column E Load	Column F NAI	Column G (MW/0.1Hz)	Column I Contingency
12/20/2008 2:12	-0.058	2869.1	-117.0	2861.2	-93.8	-40.2	N
12/27/2008 4:18	-0.066	2553.6	-138.5	2576.9	-110.8	-41.9	N
1/5/2009 9:26	-0.040	2838.7	-99.2	2857.8	-88.5	-26.5	N
1/27/2009 0:39	-0.053	2524.7	-94.4	2522.3	-13.8	-153.6	N

Point A values are averages over the period from -16 seconds to 0 seconds before initial frequency decline.

Point B values are averages over the period from 18 seconds to 52 seconds after the first scan indicating an initial frequency decline

Interconnections Frequency Events Monthly Report – Events Parameters

Eastern Interconnection

Event Time				Event Frequency Data						Interconnection	Resource Information			Candidate	Candidate	Load Resources	
UTC (t-0) Date / Time (MM/DD/YY HH:MM:SS)	Local Time (t-0) Date / Time (MM/DD/YY HH:MM:SS)	Day	Time Zone Pull Dn	A Value Freq Error (from 60)	A Value (t-16 to t-2) average	B Value (t+20 to t+52) average	Hz Delta B-A	Point C (w/in 8 sec after t-0)	delta from A_{ave}	Bias Setting MW/0.1 Hz	MW Lost Gross	MW Lost Net	Name BA	for BA List Y or N	for beta calc	Tripped Before Value B	Point C MW/0.1 Hz
07/02/2011 6:45:21	07/02/2011 2:45:21	Sat	EDT	0.004	60.004	59.956	-0.048	59.969	-0.035	6349		-975	EES				-2024
07/02/2011 14:57:18	07/02/2011 10:57:18	Sat	EDT	-0.003	59.997	59.967	-0.031	59.958	-0.039	6349		-496	TVA				-1600
07/16/2011 7:07:00	07/16/2011 3:07:00	Sat	EDT	-0.007	59.993	59.948	-0.045	59.952	-0.041	6349		-613	TVA				-1370
07/21/2011 1:28:03	07/20/2011 21:28:03	Wed	EDT	0.009	60.009	59.967	-0.042	59.968	-0.041	6349		-902	TVA				-2167
07/25/2011 18:39:08	07/25/2011 14:39:08	Mon	EDT	0.019	60.019	59.989	-0.030	59.978	-0.041	6349		-985	PJM				-3242
07/28/2011 18:47:52	07/28/2011 14:47:52	Thu	EDT	-0.004	59.996	59.946	-0.050	59.947	-0.049	6349		-1242	PJM				-2486
07/30/2011 13:41:21	07/30/2011 9:41:21	Sat	EDT	-0.013	59.987	59.945	-0.042	59.947	-0.040	6349		-1386	PJM				-3337

Western Interconnection

Event Time					Event Frequency Data						Interconnection	Resource Information			Candidate	Candidate	Load Resources	
Event ID	Event #	UTC (t-0) (MM/DD/YY HH:MM:SS)	Local Time (t-0) Date / Time (MM/DD/YY HH:MM:SS)	Day	Time Zone Pull Dn	A Value Freq Error (from 60)	A Value (t-16 to t-2) average	B Value (t+20 to t+52) average	Hz Delta B-A	Point C (w/in 8 sec after t-0) delta from A_{ave}		Bias Setting MW/0.1 Hz	MW Lost Gross	MW Lost Net	Name BA	for BA List Y or N	for beta calc	Tripped Before Value B	Point C MW/0.1 Hz
		07/03/2011 7:17:08	07/03/2011 0:17:08	Sun	PDT	-0.025	59.975	59.929	-0.046	59.901	-0.074	2024		-255	CISO				-526
		07/11/2011 4:17:33	07/10/2011 21:17:33	Sun	PDT	0.005	60.005	59.952	-0.052	59.911	-0.094	2024		-267	SRP				-496
		07/15/2011 2:46:41	07/14/2011 19:46:41	Thu	PDT	-0.035	59.965	59.928	-0.037	59.873	-0.092	2024		-264	BCHA				-706
		07/30/2011 9:17:34	07/30/2011 2:17:34	Sat	PDT	-0.007	59.993	59.937	-0.056	59.907	-0.086	2024		-426	NWMT				-763

ERCOT Interconnection

Event Time					Event Frequency Data						Interconnection	Resource Information			Candidate	Candidate	Load Resources	
Event ID	Event #	UTC (t-0) (MM/DD/YY HH:MM:SS)	Local Time (t-0) Date / Time (MM/DD/YY HH:MM:SS)	Day	Time Zone Pull Dn	A Value Freq Error (from 60)	A Value (t-16 to t-2) average	B Value (t+20 to t+52) average	Hz Delta B-A	Point C (w/in 8 sec after t-0) delta from A_{ave}		Bias Setting MW/0.1 Hz	MW Lost Gross	MW Lost Net	Name BA	for BA List Y or N	for beta calc	Tripped Before Value B	Point C MW/0.1 Hz
		07/14/2011 20:53:55	07/14/2011 15:53:55	Thu	CDT	0.023	60.023	59.923	-0.100	59.917	-0.106	653		-259	ERCOT				-259
		07/17/2011 15:18:00	07/17/2011 10:18:00	Sun	CDT	-0.005	59.995	59.894	-0.101	59.879	-0.115	653		-144	ERCOT				-143
		07/18/2011 14:13:00	07/18/2011 9:13:00	Mon	CDT	-0.042	59.958	59.863	-0.094	59.879	-0.079	653		-127	ERCOT				-134
		07/21/2011 0:17:10	07/20/2011 19:17:10	Wed	CDT	0.006	60.006	59.811	-0.194	59.799	-0.206	653		-892	ERCOT				-459
		07/24/2011 16:59:24	07/24/2011 11:59:24	Sun	CDT	-0.025	59.975	59.872	-0.102	59.846	-0.128	653		-167	ERCOT				-163
		07/25/2011 22:57:12	07/25/2011 17:57:12	Mon	CDT	0.013	60.013	59.929	-0.084	59.918	-0.095	653		-306	ERCOT				-363

Hydro Quebec

Event Time					Event Frequency Data						Interconnection	Resource Information			Candidate	Candidate	Load Resources	
Event ID	Event #	UTC (t-0) (MM/DD/YY HH:MM:SS)	Local Time (t-0) Date / Time (MM/DD/YY HH:MM:SS)	Day	Time Zone Pull Dn	A Value Freq Error (from 60)	A Value (t-16 to t-2) average	B Value (t+20 to t+52) average	Hz Delta B-A	Point C (w/in 8 sec after t-0) delta from A_{ave}		Bias Setting MW/0.1 Hz	MW Lost Gross	MW Lost Net	Name BA	for BA List Y or N	for beta calc	Tripped Before Value B	Point C MW/0.1 Hz
		07/29/2011 2:23:18	07/28/2011 22:23:18	Thu	EDT	0.006	60.006	59.879	-0.127	59.508	-0.498	420		-707	HQ				-559
		07/29/2011 2:23:26	07/28/2011 22:23:26	Thu	EDT	-0.178	59.822	59.891	0.069	59.874	0.052	420		588	HQ				-848
		07/29/2011 5:06:20	07/29/2011 1:06:20	Fri	EDT	-0.030	59.970	60.033	0.064	60.146	0.176	420		329	HQ				-517
		07/30/2011 8:06:58	07/30/2011 4:06:58	Sat	EDT	-0.025	59.975	60.022	0.047	60.109	0.134	420		113	HQ				-239
		07/31/2011 19:32:24	07/31/2011 15:32:24	Sun	EDT	-0.003	59.997	60.081	0.085	60.402	0.405	420		447	HQ				-527

Interconnections Frequency Events Monthly Report – Frequency Patterns

EASTERN INTERCONNECTION
AUGUST, 2011 FREQUENCY EVENTS